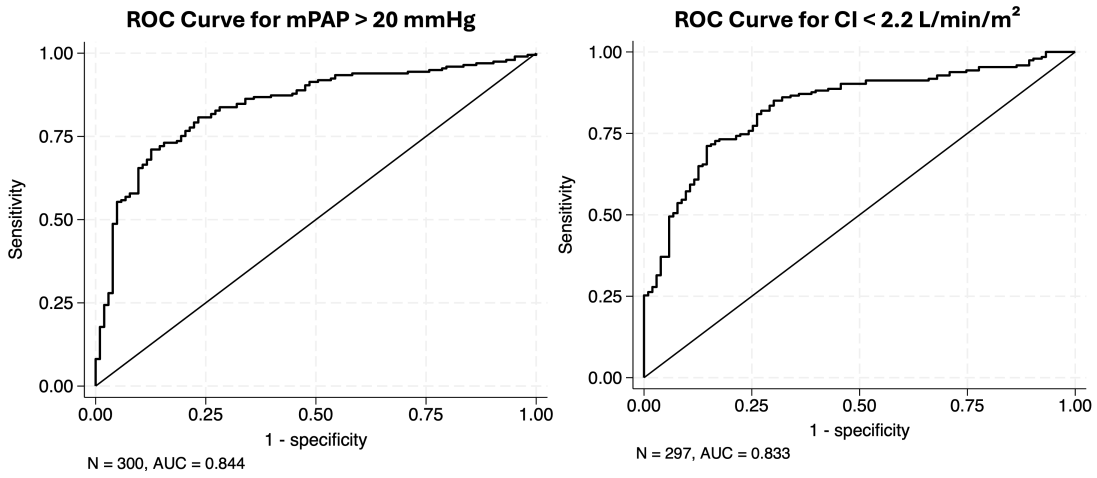
Non-invasive classification of cardiac index and mean pulmonary artery pressure versus right-heart catheterization in CAPTURE-HF study

Background: Given limited access to timely right heart catheterization (RHC) data in acute heart failure, non-invasive assessment of cardiac index (CI) and mean pulmonary artery pressure (mPAP) could enable earlier recognition of hemodynamic derangement. CAPTURE-HF sought to validate machine-learning (ML) classifiers for normal CI and elevated mPAP using non-invasive biosignals acquired during RHC.

Methods: In a prospective multicentre study, 1,568 adults undergoing RHC were enrolled (Phase 1 ML-development n=1,240; Phase 2 locked-ML validation n=328 at 6 new sites). A 5-min supine non-invasive recording with a multi-modal sensor device was paired with core-laboratory adjudicated invasive RHC data. Models targeted CI < 2.2 L/min/m^2 and mPAP >20 mmHg; PCWP & RAP analyses have been previously reported.

Summary statistics: Mean age 62.8 years; 62.8% male, 76.8% White, 52.9% U.S. NYHA: unknown 36%, I 1%, II 17%, III 38%, IV 7%. RHC indications: symptoms 23.2%, transplant/LVAD eval 24.3%, suspected PH 16.3%, surveillance/follow-up 16%, other 20.2%.

Results: In the validation cohort (n=297), area under the curve (AUC) was 0.83 for CI and 0.84 for mPAP. For CI < 2.2, sensitivity was 85% and specificity 71% (PPV 61%, NPV 90%). For mPAP >20, sensitivity was 71% and specificity 87% (PPV 92%, NPV 61%).



Conclusion: A non-invasive multisensor approach can classify normal CI and elevated mPAP relative to invasive RHC in a prospective multicentre population. Performance characteristics support its use for ruling in elevated mPAP and ruling out low CI, whereas identification of low CI and normal mPAP is less robust.